A Vision Based Humanoid
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Abstract:
Humanoid is anything which resembles a human or it is human like...Late in the 90’s, humanoids came into existence due to advancement in technology. Humanoid is an autonomous robot which is capable of adapting itself with the change in the surrounding environment and continue to reach its goal. Now we have advanced humanoid robots like Asimo, Sophia etc. The actual purpose of the humanoid is to make the task or work simple, as they are able to process and give the output almost any input which we provide. Also in contrasts to conventional robots, humanoids make use of artificial intelligence to recognize and solve day to day problems. The base components of a humanoid robot are the processor and other peripherals. The problems that we are facing today is lack of efficiency in various fields where utmost precision is required. In this paper, we show the basic design structure to develop a humanoid robot which will help in personal assistance and entertainment, apart from which it can also be used in multi-domain applications in medical field, industries, scientific research and in normal day to day usage.

Keywords: Humanoid, Asimo, Sophia, Artificial intelligence, Personal assistance, Multi-domain application

I. INTRODUCTION

A Humanoid robot is a robot whose body structure resembles to that of the human. And apart from just resembling human body, the functions that are performed by the humanoid robots also tend to mimic the human activities. The history of robots has its origins in the ancient history. The modern concept of a humanoid robot began to be developed. The history of robots has its origins in the ancient history. The modern concept of a humanoid robot began to be developed with the onset of the Industrial Revolution, which allowed the usage of complex machineries, and the introduction of electricity, in the year of 1941 the prolific writer, Isaac Asimov, formulated the three laws which form the basic guidelines for robotic, as mentioned below:

First Law- A robot must not injure a human being or, allow a human to be in danger or harm.

Second Law- A robot must obey the orders given to it by a human except where such orders would conflict with the First Law.

Third Law- A robot must to be able to protect its own existence as long as such protections does not conflict with the First or Second Laws.

In the year 1960 the first digitally programmable robot, Unimate was sold to General Motors, this was made possible with the help of power machines integrated with compact motors. In the early 20th century, the concept of a humanoid robot was envisioned, such as in the 80’s Honda began its humanoid research and development program that culminated with the making of Asimo. Today, one can contemplate human-sized robots with the ability for near-human mindset and movement. The first usage of robots were in the industries as industrial robots, they were simple machines capable of handling manufacturing tasks which allowed for increased production with less need for human assistance. With the beginning of new era in field of technology digitally controlled robots and robots using artificial intelligence came into existence since the 2000s. Although we have come a long way in terms of designing humanoids such as, the case with Asimo and Sophia, we still are yet to achieve satisfactory results where critical thinking is required. Despite using artificial intelligence, we have not implemented cognitive skills that are comparable to humans. Irrespective of increase in the affordability of consumer electronics, these humanoids are still prohibitively expensive and are complicated to operate and hence making it hard for the general mass to access it.

I. Need for Humanoid

In today’s tech-savvy world, the need for smart electronic devices is growing drastically. But the market for human like robots is yet to take off. There are various fields in which humanoids perform far better than their human counter parts. The application of these humanoids would result in increased efficiency, eliminate errors and in general would improve the quality of human life.

Some of the applications of these humanoids are discussed below:

Medical field: Robot assisted surgery is commonplace when it comes to precise and minimally invasive surgical procedures, they are used to aid the surgeons while performing potentially life threatening operations.

Disaster relief: In these times of distress there is a necessity of human skill but without risking more human lives, humanoids can fulfil this role as they can be designed to be sufficiently smart enough and they do not harm any people involved, in addition humanoids can infiltrate hazardous areas for search and rescue missions.

Industries: Industries are the largest benefactors of automated robotics and these automated mechanisms ushered in the biggest industrial revolution in human history, they exponentially increase production rates while drastically reduce costs and other drawbacks related to manual labour.

Personal assistant: Personal assistant is a tedious job which requires not much complex thought but just the right amount of intelligence, hence the humanoids perfectly fit the bill. Humanoid robots designed with A.I have access to immense expanse of data, by analyzing this data a smart enough
Humanoid can study, group and predict outcomes, these outcomes can be in form of suggestions and can help a person make smart choices. Although the humanoid robots have enormous potential in terms of application that is just waiting to be tapped into, they have their limitations and boundaries. The general masses have many false notions and misconceptions that lead them to think that humanoids will eventually replace humans and solve all the problems in the future, but it couldn’t be further from the truth, the most advanced of these A.I systems, natural language processing and object recognition depend merely on sophisticated pattern matching techniques, and also very importantly the cost of these humanoids can be upwards of millions of dollars for a single unit not taking into account the level of technical expertise required to operate them, but nonetheless tough challenges are what drive meaningful growth, research and innovation contribute to creation of better quality products not only specific to humanoid robots, and to demonstrate that it is possible to design cheaper and easier to operate yet sufficiently sophisticated humanoid robot we showcase a prototype model.

II. WORKING METHODOLOGY

The central unit of this humanoid is Raspberry Pi that takes care of the processing and controls the whole system. The proposed block diagram is as shown:

![Proposed block diagram](image)

The above configuration is powered using rechargeable batteries which are mounted inside the humanoid to make it look aesthetically pleasing. The movement of the humanoid is achieved by fixing wheels to the chassis. And the wheels are controlled by four separate independent DC motors which enhance the range of motion of the humanoid. And the functionality of the humanoid is further increased by using various sensors such as motion sensor which is used to judge the proximity and we gauge the distances with the help of obstacle sensor. Pi camera is used for object detection and recognition, this adds another level of interactivity to our humanoid which is needed for real world application. The model is installed with a LCD module so that the user can supervise the humanoid.

Hardware Requirements
The hardware requirements are as follows:

- Raspberry Pi 3 B+
  - SoC: BroadcomBCM2837B0 quad-core A53 (ARMv8)
  - 64-bit @ 1.4GHz.
- RAM: 1GB LPDDR2 SDRAM.
- Networking: Gigabit Ethernet (via USB channel), 2.4GHz and 5GHz 802.11b/g/n/ac Wi-Fi.

Pi Camera:
- 8 megapixel camera capable of taking photographs of 3280 x 2464 pixels.
- Capture video at 1080p30, 720p60 and 640x480p90 resolutions.

Ultrasonic Sensor:
- Power Supply: 5V DC
- Input Current: <2mA
- Effective Angle: <15°
- Ranging Distance: 2cm – 500 cm/1” - 16ft
- Resolution: 0.3 cm

IR Sensor:
- Operating Voltage : 3.6 - 5V DC
- Current Consumption : 0.06mA
- Detection Angle : 35 deg
- Measuring Range : 2 - 30 cm

Relay Circuit:
- 8 Channel isolated ports
- Operating Range : 250V/10A AC, 5V/10A DC
- High impedance controller pin

DC Motors
- Operating Voltage - 24V
- Current Rating- 0.37 A
- Speed - 5000rpm

LCD Display
- 800x480 RGB LCD display
- Operating Temperature : -20 to +70 deg centigrade
- 24-bit color

Software Requirements
The humanoid robot was designed and programmed using the following:

Python:
We use Python version 3.7 and its extensive supporting libraries. The reasons for using Python over other programming languages are follows:
- Python is a general purpose programming language with easier syntax, hence it makes its easy to write programs.
- Python is a language that is freely available to access and has vast collection of open source libraries which are constantly updated.
- It is a very light weight language, that is, it takes up less resources which is necessary to meet the real time requirements as in the case of a humanoid.

Blynk:
It is the software that is used to remotely control the humanoid through use of internet of things. The information that is generated or received by the humanoid is stored in a cloud data base and can be accessed when necessary.

Solid edge:
Solid edge is a computer aided design software that is used to design, visualize and create the basic 3D model for the prototype humanoid, and to fabricate.

III. PROTOTYPE DESIGN
The fabricated prototype model’s dimensions are as follows,
Chassis: 500mm x 500mm
Height: 500mm (Body) 150mm (Head)
Diameter: 400mm (Body) 300mm (Head)
Material used: 16 Gauge MS Sheet
Weight: 16kg approximately

Figure 2. Fabricated model

The 3 Dimensional CAD design is as shown

Figure 3. Proposed Prototype Model, starting from top left in clockwise direction, (a) Top view, (b) Isometric view, (c) Side view, (d) Front view

In our paper we show how to develop a multipurpose humanoid robot, the humanoid can also be configured to assist personally.

- We have implemented features of motion by adding wheels for locomotion and also provided hand movements for pick and place operation for different applications.
- The humanoid is given with a 17 inch LCD which displays images captured by the Pi camera and to display required information.
- It has a camera module, the Pi camera that helps capture high definition images and videos. It attaches via a 15cm ribbon cable to the CSI port on the Raspberry Pi.
- The humanoid has been given with a number of relays and sensors.
- An obstacle sensor is used in the humanoid which is an electronic instrument that is used to sense certain characteristics of its surroundings. It does this by either emitting or detecting infrared radiation.
- Apart from this we have used motion sensor which is often integrated as a component of a system that automatically performs a task or alerts a user of motion in an area.

- A 8 channel relay unit is used which is electrically operated and used to control various appliances and equipment with large current in specific the DC motors.
- The humanoid is basically been operated by our main hardware component which is the Raspberry Pi 3 B model. This acts like a small computer and helps interface the rest of the components that has been used in the humanoid.

IV. CONCLUSION

To conclude we can say that there is a growing need for humanoids all over the world because of their better performance parameters especially when it comes to redundant tasks. Over the past decade in humanoid research, an encouraging spectrum of science and technology has emerged which may lead to the development of highly advanced humanoid systems endowed with rich and complex capabilities. As we are living in a fast paced life we require instant results which can be achieved with the help of humanoids as they have the potential ability to enhance and help us in almost all aspects of our daily life. Ambitious goals have been set for future humanoid robotics.

V. REFERENCES


